PATENT SPECIFICATION

531,009

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COMPLETE SPECIFICATION

Improvements in Two-Stroke Cycle Internal Combustion Engines

We, EDWARD MOLLER, Naturalised British Subject, HERBERT FRANK PERCY PURDAY, British Subject, and FREDERICK ERNEST REBBECK, British Subject, all of Harland and Wolff, Limited, of Queen's Island, Belfast, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to two-stroke cycle internal combustion engines of the kind having two, four, six or any even number of cylinders with their axes all arranged in one plane and the cylinders arranged in pairs in such a way that the two cylinders of a pair are opposed to one another and are symmetrically or approximately symmetrically disposed at opposite sides of a common crankshaft also lying in the plane containing the cylinder axes.

The invention consists essentially in the provision, in an engine of the kind described, or two opposed pistons in each cylinder, each pair of pistons nearer to the engine crankshaft being connected to the latter by connecting rods working on a common crankpin, and the pair of outer pistons having a stroke equal to or less than the stroke of the inner pistons and being controlled by mechanism operatively connecting the outer pistons to the engine crankshaft. The combustion chamber in each cylinder is formed in known manner by the space between the two pistons in each cylinder.

The controlling mechanism by means of which the outer pistons are operatively connected to the engine crankshaft may comprise tie rods connecting the pair of outer pistons and operated or controlled by a pair of eccentrics or crankpins arranged on opposite sides of the crank which carries the crankpin common to the corresponding pair of inner pistons. Alternatively, the outer pistons may be operatively connected to an auxiliary shaft which, in turn, is operatively connected to or controlled by the engine crankshaft by means of spur wheel gearing or other mechanism interconnecting the shafts for transmitting rotory motion from one shaft to the other.

[*Price* 1/-]

The accompanying drawings diagrammatically illustrate various ways of carrying the invention into effect.

Fig. 1 is a sectional view through one pair of opposed cylinders with the controlling mechanism for the outer pistons omitted for the sake of clearness. Fig. 2 is a similar sectional view showing the controlling mechanism for the outer pistons and omitting the common crankpin and connecting rods for the inner pistons, likewise for the sake of clearness.

Figs. 3 and 4 are views similar to Fig. 2, each showing a different form of controlling mechanism for the outer pistons.

Figs. 2*a*, 3*a* and 4*a* are face views of the yoke members which connect the tie rods shown in Figs. 2, 3 and 4 respectively.

Fig. 5 is a sectional view through a pair of opposed cylinders having outer pistons controlled through the medium of an auxiliary shaft geared to the engine crankshaft.

In Figs. 1 and 5 it will be seen that the engine crankshaft A has a crankpin B common to a pair of opposed connecting rods C^1, and C^2 which are attached to a pair of inner pistons D^1 and D^2 working n a pair of opposed cylinders E^1 and E^2, which are coaxial with one another and arranged on opposite sides of the crankshaft A. The cylinders E^1 and E^2 are also each fitted with an outer piston, F^1 and F^2 respectively.

Referring now to Fig. 2, which shows one arrangement of controlling mechanism for the outer pistons F^1 and F^2, the latter are rigidly secured by rectangular yoke members N^1 and N^2 to the ends of four tie rods G which are also rigidly secured to a frame member H disposed between the cylinders E^1 and E^2 and suitably apertured to allow the connecting rod C^2 to have free movements therein. Two journal pins H^2 on opposite sides of the frame member H are journalled in lugs on a pair of eccentric straps J operated by a pair of eccentrics K on the crankshaft A and one on each side of the crank carrying the crankpin B. The rods G are guided by sleeves or guides L in the engine framing V, to take the side thrust on the rods G due to the thrust of the eccentrics K. In Fig. 2 the frame mem-

ber H connects all the four tie rods and is arranged at right angles to the rods G. It will be apparent that such a frame member might be replaced by a pair of cross members connecting the tie rods together in pairs, one cross member being operated by the eccentric and eccentric strap at one side of the crank carrying the crankpin B, and the other cross member being operated by the eccentric and eccentric strap at the opposite side of the said crank.

Fig. 3 shows an arrangement in which two members H_3 connect the tie rods G in pairs, the members H^3 being disposed in a plane at right angles to the crankshaft axis. Each member H^3 takes the form of a crosshead guide for a slide block M which reciprocates in the guide member H^3 and forms the eccentric strap of the eccentric K on the crankshaft. As in Fig. 2, there are two eccentrics K, one on each side of the crank of the common crankpin B, each eccentric working in a block M in one of the guide members H^3. Obviously the two guide members H^3 could be integral with each other or connected together to form a prismatic frame connecting the four tie rods together.

Fig. 4 shows a further arrangement in which only two tie rods G are connected to each outer piston F^1 or F^2 through a yoke piece N^4 (Fig. 4a). The inner end of each tie rod G is secured to a slotted crosshead H^4 in the slot of which the slide block M reciprocates. There are two crossheads H^4, each guiding a slide block M, one for each eccentric K as in Fig. 3. The crossheads H^4 slide between guides L^4 on the engine framing V and the two crossheads H^4 may be inter-connected or integral with each other if desired.

In the construction shown in Fig. 5 the outer piston F^1 is connected by a link P^1 to one end of a rocking lever Q^1, the other end of which is attached to a coupling rod R^1 working at its other end on a crankpin S or eccentric on an auxiliary shaft T. Similarly the outer piston F^2 is operatively connected to the crankpin S by a link P^2, rocking lever Q^2 and coupling rod R^2. The shaft T is geared to the engine crankshaft A by gear wheels W.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A two-stroke internal combustion engine of the kind described, having two opposed pistons in each cylinder of an opposed pair of cylinders, each pair of inner pistons being connected by connecting rods to a common crankpin on the engine crankshaft, and the corresponding pair of outer pistons having a stroke equal to or less than the stroke of the inner pistons and being operatively connected to the engine crankshaft by controlling mechanism.

2. An internal combustion engine as claimed in claim 1 in which the controlling mechanism comprises tie rods connecting the pair of outer pistons, and a pair of eccentrics or crankpins operating or controlling said tie rods and arranged on opposite sides of the crank carrying the crankpin common to the corresponding pair of inner pistons.

3. An internal combustion engine as claimed in claim 2 in which the tie rods connect the pair of outer pistons to a member or members reciprocated by the pair of eccentrics or crankpins.

4. An integral combustion engine as claimed in claim 2 or 3 in which the tie rods connect the pair of outer pistons to a pair of guides, one for each of a pair of slide members reciprocated by the pair of eccentrics or crankpins.

5. An internal combustion engine as claimed in claim 1, in which the controlling mechanism for the pair of outer pistons comprises an auxiliary shaft operatively connected to the engine crankshaft and operatively connected to the pair of outer pistons.

6. Two-stroke internal combustion engines of the kind described constructed substantially as herein described with reference to the accompanying drawings.

Dated this 7th day of July, 1939.

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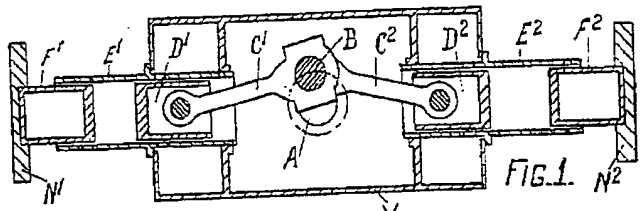

FIG. 1.

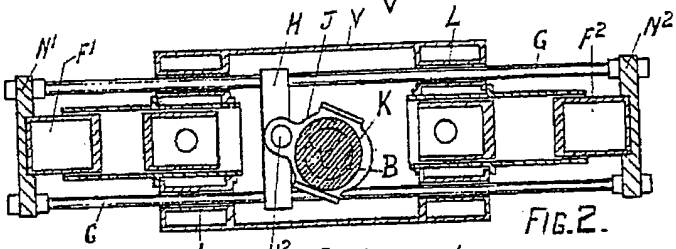

FIG. 2.

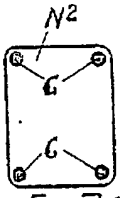

FIG. 2a.

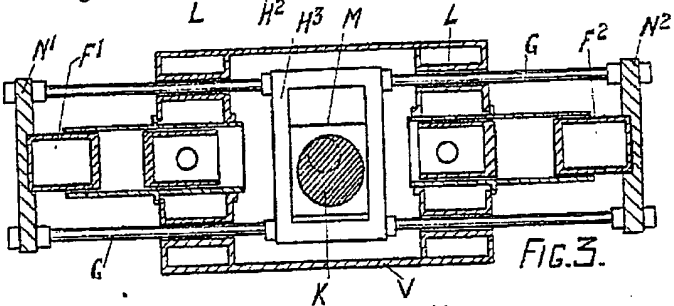

FIG. 3.

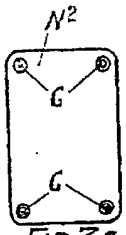

FIG. 3a.

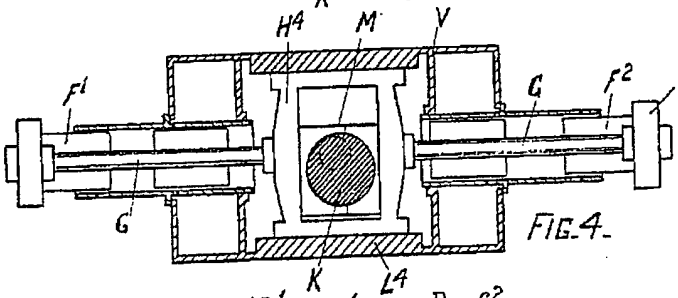

FIG. 4.

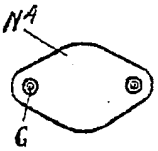

FIG. 4a.

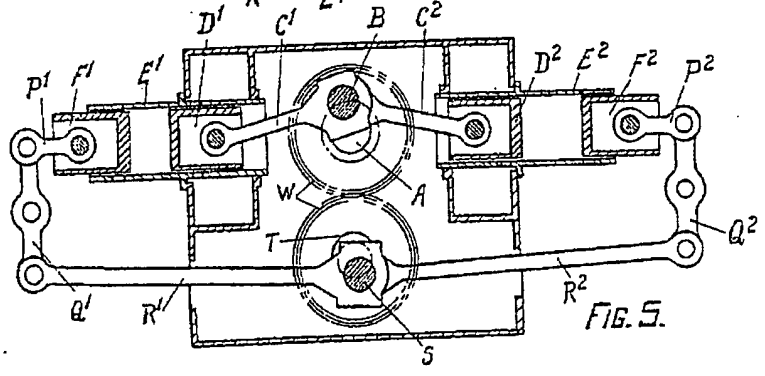

FIG. 5.

Malby & Sons, Photo-Lith